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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,207	06/19/2001	Tuqiang Ni	015290-504	9862

7590

01/14/2003

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 01/14/2003

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/883,207

Applicant(s)

NI ET AL.

Examiner

DuyVu n Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6.

- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
2. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation "the oxygen-containing gas maintains a desired thickness of the sidewall polymer" is vague and indefinite because it is unclear what desired thickness being maintained by the oxygen-containing gas.
3. Claim 6 recites the limitation "etch stop" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al. (US 6,403,488), Bobbio et al. (US 4,615,764), and Khajehpour et al. (US 6,117,786).

Yang describes a method for etching oxide layer including BPSG and low-k materials, useful in a SAC etch process, with a plasma that are formed from gases such as CHF₃, SF₆ (sulfur-containing gas), and carrier gas, Ar (col. 2, line 62-col. 3, line 10). Unlike claimed invention, Yang doesn't describe the plasma including oxygen-containing gas. Bobbio describes

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an etching method for oxide where he teaches of adding oxidizing components including O₂ and SO₂ (sulfur-containing gas) (ab.; summery). It would have been obvious for one skilled in the art at the time of the invention in light of Bobbio to add oxidizing components including O₂ and SO₂ (sulfur-containing gas) in order to enhance etching selectivity of the oxide (ab.). Furthermore, profile control of the etched openings (straight openings) by controlling the amount of oxidizing components are known to one skilled in the art as described by Khajehpour (col. 3, line 20-25). Therefore, one skilled in the art would find it obvious to control the amount of the etching components such as O₂ and SO₂ (sulfur-containing gas) in order to control the profile of the etched openings.

Referring to claim 3, since the etchant above are the same as the claimed invention, they would also provide the same effect as those cited in claim 3.

Referring to claim 14, Yang describes the openings aspect ratio is preferable >4:1 and the size of the opening is less than 0.3 μm (col. 6, line 31-36). Even though he doesn't describe the depth is at least 2 μm (claim 15) nor the aspect ratio of at least 10:1 (claim 17); however, it would have been obvious for one skilled in the art to determine the optimum depth and aspect ratio through routine experimentation depending on the type of device structure being processed to provide an opening with a reasonable expectation of success. Khajehpour describes an opening having depth greater than 2 μm (col.4, line 35).

Referring to claims 4, 5, Yang describes conventional reactor having RF or dual RF and reactor such as microwave magnetic etcher, HDP can be used (col. 6, line 6-31). Khajehpour also describe reactor having RF energy applied to the top and bottom electrode for etching (col. 4, line 62-col. 5, line 5).

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Referring to claim 6, Khajehpour suggests oxygen supplied at 3-15 sccm in order to obtain straight sidewalls (col. 3, line 37-52). This amount would be effective to provide undissociated SO₂ molecules.

Referring to claims 8, 18, 19, Yang describes that the etching conditions are those typically used for oxide etching and they includes a P of 60-200 mTorr, etching gas flow rate of 15-50 sccm, Ar flow rate of 0-500 sccm (col. 5, line 37, 45, 52). Other conditions are disclosed by Khajehpour, in which depending on the reactor being used. He describes a P of less than 200 mTorr and substrate support T of -10 to 40 degrees Celsius (col. 4, line 36-62), a top power of 1000 watts, and a bottom power of 2000 watts, flow rate of etching gas such as C₄F₈ at 5-8 sccm, and O₂ at 3-15 sccm (col. 3, line 37-52; col. 4, line 27).

Referring to claims 7, 12, 13, 18, 19, unlike claimed invention, above prior art doesn't describe flow rate of SO₂ and the flow ratio between O₂ and SO₂. However, since both are oxidizing components and Khajehpour teaches that it is desirable to control oxygen addition in order to obtain straight sidewalls which are about 3-15 sccm (col. 3, line 38-48). Therefore, it would have been obvious to one skilled in the art to determine the flow rate of SO₂ through routine experimentation in order to obtain the optimum flow rate of SO₂ in order to obtain straight sidewalls with a reasonable expectation of success.

Drawings

6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: figure 3, reference sign 20. A proposed drawing correction, corrected drawings, or amendment to the specification to add


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the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

January 8, 2003


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